

Electronic force sensing with sensor normalization

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Abstract

Methods and apparatus are disclosed for normalizing electronic sensor data to correct for variations in individual sensor transfer characteristics which are not known in advance. A general characteristic transfer function for a sensor type of interest is determined empirically. A baseline response reading is acquired from an individual sensor, and that baseline response applied to the general transfer function to determine a specific transfer function for the individual sensor. The specific transfer function is used to calculate normalized data. One application of the invention is in computer cursor control pointing devices such as a joystick. Because the invention compensates for wide variations in sensor characteristics, inexpensive sensors such as force-sensitive resistors may be used in a joystick without sacrificing pointing accuracy and ergonomic efficiency.

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[54] ELECTRONIC FORCE SENSING WITH
SENSOR NORMALIZATION0535907A2 4/1993 European Pat. Off.
352370A1 6/1985 Germany
3913648C1 4/1989 Germany[75] Inventors: Daniel R. Brown, Beaver Creek;
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04545 12/1988 WIPO[73] Assignee: InControl Solutions, Inc., Clackamas,
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00822 4/1989 WIPO

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OTHER PUBLICATIONS

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Lindahl, "A Digital compensation Technique for Pres-
sure Transducers", 1982, pp. 343-344.[51] Int. Cl. 6 G04F 10/00; G01L 7/04
[52] U.S. Cl. 324/601; 324/130;
364/571.01Primary Examiner—Ernest F. Karlsen
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& Stolowitz[58] Field of Search 324/115, 73.1, 132,
324/74, 130, 601; 345/159, 161;
364/571.01-571.08

[57] ABSTRACT

[56] References Cited

Methods and apparatus are disclosed for normalizing electronic sensor data to correct for variations in individual sensor transfer characteristics which are not known in advance. A general characteristic transfer function for a sensor type of interest is determined empirically. A baseline response reading is acquired from an individual sensor, and that baseline response applied to the general transfer function to determine a specific transfer function for the individual sensor. The specific transfer function is used to calculate normalized data. One application of the invention is in computer cursor control pointing devices such as a joystick. Because the invention compensates for wide variations in sensor characteristics, inexpensive sensors such as force-sensitive resistors may be used in a joystick without sacrificing pointing accuracy and ergonomic efficiency.

U.S. PATENT DOCUMENTS

4,374,381 2/1983 Ng et al. 340/711
4,399,515 8/1983 Gross 364/571.04
4,446,715 8/1984 Bailey 364/571.02
4,716,536 12/1987 Blanchard 364/571.04
4,725,950 2/1988 Woods 364/571.06
5,012,231 4/1991 Felsenstein 340/709
5,095,453 3/1992 Pierson et al. 364/571.05
5,135,002 4/1992 Kirchner et al. 364/571.03
5,247,467 9/1993 Nguyen et al. 364/571.02
5,269,311 12/1993 Kirchner et al. 364/571.02
5,345,400 9/1994 Bissell et al. 364/571.01
5,347,476 9/1994 McBean, Sr. 364/571.04

FOREIGN PATENT DOCUMENTS

0302385A2 7/1988 European Pat. Off. .

13 Claims, 8 Drawing Sheets

